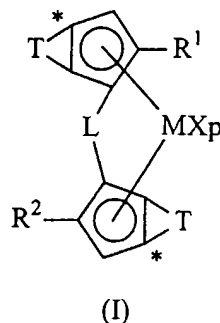


Claims

1. A multistage process comprising the following steps:

- a) polymerizing propylene and optionally one or more monomers selected from ethylene and alpha olefins of formula $\text{CH}_2=\text{CHT}^1$, wherein T^1 is a $\text{C}_2\text{-C}_{20}$ alkyl radical in the presence of a catalysts system, supported on an inert carrier comprising:
 - i) one or more metallocene compound of formula (I):



wherein:

M is an atom of a transition metal selected from those belonging to group 3, 4, 5, 6 or to the lanthanide or actinide groups in the Periodic Table of the Elements;

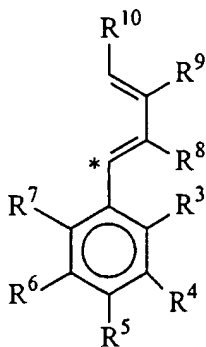
p is an integer from 0 to 3, being equal to the formal oxidation state of the metal M minus 2;

X, same or different, is a hydrogen atom, a halogen atom, or a R, OR, OSO_2CF_3 , OCOR , SR, NR_2 or PR_2 group, wherein R is a linear or branched, saturated or unsaturated $\text{C}_1\text{-C}_{20}$ alkyl, $\text{C}_3\text{-C}_{20}$ cycloalkyl, $\text{C}_6\text{-C}_{20}$ aryl, $\text{C}_7\text{-C}_{20}$ alkylaryl or $\text{C}_7\text{-C}_{20}$ arylalkyl radical, optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two X can optionally form a substituted or unsubstituted butadienyl radical or a $\text{OR}'\text{O}$ group wherein R' is a divalent radical selected from $\text{C}_1\text{-C}_{20}$ alkylidene, $\text{C}_6\text{-C}_{40}$ arylidene, $\text{C}_7\text{-C}_{40}$ alkylarylidene and $\text{C}_7\text{-C}_{40}$ arylalkylidene radicals;

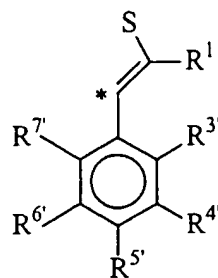
L is a divalent bridging group selected from $\text{C}_1\text{-C}_{20}$ alkylidene, $\text{C}_3\text{-C}_{20}$ cycloalkylidene, $\text{C}_6\text{-C}_{20}$ arylidene, $\text{C}_7\text{-C}_{20}$ alkylarylidene, or $\text{C}_7\text{-C}_{20}$ arylalkylidene radicals optionally containing heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements, and silylidene radical containing up to 5 silicon atoms;

R^1 and R^2 , equal to or different from each other, are linear or branched, saturated or unsaturated C_1 - C_{20} -alkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

T, equal to or different from each other, is a moiety of formula (IIa) or (IIb):



(IIa)



(IIb)

wherein:

the atom marked with the symbol * bonds the atom marked with the same symbol in the compound of formula (I);

R^3 , R^4 , R^5 , R^6 and R^7 , equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C_1 - C_{40} -alkyl, C_3 - C_{40} -cycloalkyl, C_6 - C_{40} -aryl, C_7 - C_{40} -alkylaryl, or C_7 - C_{40} -arylalkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two or more R^3 , R^4 , R^5 , R^6 and R^7 can join to form a 4-7 saturated or unsaturated membered rings, said ring can bear C_1 - C_{20} alkyl substituents; with the proviso that at least one among R^3 , R^4 , R^5 , R^6 and R^7 is a linear or branched, saturated or unsaturated C_1 - C_{40} -alkyl, C_3 - C_{40} -cycloalkyl, C_6 - C_{40} -aryl, C_7 - C_{40} -alkylaryl, or C_7 - C_{40} -arylalkyl radical optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R^8 , R^9 and R^{10} , equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C_1 - C_{20} -alkyl, C_3 - C_{20} -cycloalkyl, C_6 - C_{20} -aryl, C_7 - C_{20} -alkylaryl, or C_7 - C_{20} -arylalkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two or more R^8 , R^9 and R^{10} can join to form a 4-7

saturated or unsaturated membered rings, said ring can bear one or more C₁-C₁₀ alkyl substituents;

R¹¹ is a hydrogen atom or a linear or branched, saturated or unsaturated C₁-C₂₀-alkyl, C₃-C₂₀-cycloalkyl, C₆-C₂₀-aryl, C₇-C₂₀-alkylaryl, or C₇-C₂₀-arylalkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements;

R^{3'}, R^{4'}, R^{5'}, R^{6'} and R^{7'} equal to or different from each other, are hydrogen atoms or linear or branched, saturated or unsaturated C₁-C₄₀-alkyl, C₃-C₄₀-cycloalkyl, C₆-C₄₀-aryl, C₇-C₄₀-alkylaryl, or C₇-C₄₀-arylalkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements; or two or more R^{3'}, R^{4'}, R^{5'}, R^{6'} and R^{7'} can join to form a 4-7 saturated or unsaturated membered rings, said ring can bear C₁-C₁₀ alkyl substituents;

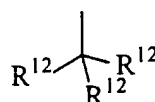
- ii) an alumoxane or a compound capable of forming an alkyl metallocene cation;
- b) contacting, under polymerization conditions, in a gas phase, ethylene with one or more alpha olefins of formula CH₂=CHT¹, wherein T¹ is a C₂-C₂₀ alkyl radical, and optionally with a non-conjugated diene, in the presence of the polymer obtained in step a)

wherein the amount of the polymer obtained in step a) is higher than 4% and lower than 20% by weight of the polymer obtained in the whole process and the amount of polymer obtained in step b) is higher than 80% by weight and lower than 96% by weight of the polymer obtained in the whole process.

2. The process according to claim 1 wherein the catalyst system further comprises iii) an organo aluminum compound.
3. The process according to claims 1 or 2 wherein step b) is carried out in the presence of an additional organo aluminum compound.
4. The process according to anyone of claims 1-3 wherein in the compound of formula (I) M is titanium, zirconium or hafnium; p is 2; X is a hydrogen atom, a halogen atom or a R group wherein R is defined as in claim 1; L is selected from the group consisting of Si(CH₃)₂, SiPh₂, SiPhMe, SiMe(SiMe₃), CH₂, (CH₂)₂, (CH₂)₃ and C(CH₃)₂; and R¹ and R² are methyl or ethyl radicals.
5. The process according to anyone of claims 1-4 wherein at least one among R^{3'}, R^{4'}, R^{5'}, R^{6'} and R^{7'} is a linear or branched, saturated or unsaturated C₁-C₄₀-alkyl,

C₃-C₄₀-cycloalkyl, C₆-C₄₀-aryl, C₇-C₄₀-alkylaryl, or C₇-C₄₀-arylalkyl radical, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements.

6. The process according to anyone of claims 1-5 wherein R⁵ and R^{5'}, equal to or different from each other, are linear or branched, saturated or unsaturated C₁-C₄₀-alkyl, C₃-C₄₀-cycloalkyl, C₆-C₄₀-aryl, C₇-C₄₀-alkylaryl, or C₇-C₄₀-arylalkyl radicals, optionally containing one or more heteroatoms belonging to groups 13-17 of the Periodic Table of the Elements.
7. The process according to claim 6 wherein R⁵ and R^{5'}, equal to or different from each other, are branched C₁-C₄₀-alkyl radicals.
8. The process according to claim 7 wherein R⁵ and R^{5'} are groups of formula (III):



(III)

wherein R¹², equal to or different from each other, is a C₁-C₁₀ alkyl radical.

9. The process according to anyone of claims 1 to 8 wherein in the compounds of formula (I) R³, R⁴, R⁶, R⁷, R^{3'}, R^{4'}, R^{6'} and R^{7'} are hydrogen atoms and R¹¹ is a linear or branched, saturated C₁-C₂₀-alkyl.
10. The process according to anyone of claims 1 to 9 wherein in the compound of formula (I) T are the same and they have formula (IIa) wherein R⁹ is a C₁-C₂₀ alkyl radical.
11. The process according to anyone of claims 1 to 9 wherein in the compound of formula (I) T are the same and they have formula (IIb).
12. The process according to anyone of claims 1 to 9 wherein in the compound of formula (I) T are the same and they have formula (IIa) wherein R⁹ is a hydrogen atom.
13. The process according to anyone of claims 1 to 9 wherein in the compound of formula (I) T are different and they have formulas (IIb) and (IIa).
14. The process according to anyone of claims 1 to 9 wherein in the compound of formula (I) T are the same and they have formula (IIb), wherein R¹¹ is a linear or branched, saturated C₁-C₂₀-alkyl radical.
15. The process according to anyone of claims 1 to 14 wherein the inert carrier is a porous organic polymer.

16. The process according to anyone of claims 1 to 15 wherein step a) further comprises a prepolymerization step a-1) in which the catalyst system described in claim 1 is prepolymerized.
17. The process according to anyone of claims 1 to 16 wherein step a) is carried out in the presence of hydrogen.
18. The process according to anyone of claims 1 to 17 wherein step b) is carried out in the presence of hydrogen.
19. The process according to anyone of claims 1 to 18 wherein in step a) from 10% to 18% by weight of a propylene homopolymer or propylene copolymer containing up to 20% by mol of derived units of ethylene or one or more alpha olefins of formula $\text{CH}_2=\text{CHT}^1$ is produced.
20. The process according to anyone of claims 1 to 19 wherein in step b) from 82% to 90% by weight of an ethylene copolymer having from 3% by mol to 60% by mol of derived units of comonomers of formula $\text{CH}_2=\text{CHT}^1$ and optionally up to 20% of derived units of non conjugated diene, is produced.
21. The process according to anyone of claims 1 to 20 wherein in step a) a propylene homopolymer is produced.
22. The process according to anyone of claims 1 to 21 wherein in step b) an ethylene 1-butene copolymer having a 1-butene content ranging from 5% to 45% by mol is produced.